

REMARKS

Claims 1, 22, 23, 27, 28, 30 and 32-37, as amended, remain herein. Claims 7-21, 24, 26, 29 and 31 have been cancelled without prejudice. Claims 1, 22, 27 and 30 have been amended. New claims 32-37 have been added. Support for the amendments and the new claims may be found throughout the specification (see, e.g., original claims).

1. Claims 7, 8, 14, 18-23, 30 and 31 were rejected under 35 U.S.C. § 112, first paragraph. Claims 7, 14 and 18 have been cancelled thereby mooting the rejection of those claims. The remaining pending claims have been amended to moot this rejection.

2. Claim 9 was rejected under 35 U.S.C. § 102(b) over Tanaka et al. U.S. Patent 6,107,734. Claim 9 has been cancelled thereby mooting the rejection of that claim.

3. Claims 1, 7, 24, 26, 28 and 31 were rejected under 35 U.S.C. § 103(a) over Tanaka in view of Mori U.S. Patent 6,215,245 and Tsutsui et al. U.S. Patent Application Publication 2003/0127967.

Applicants' claim 1 recites an organic electroluminescent device comprising: at least two or more emitting layers between an anode and a cathode, and an intermediate electrode layer being interposed between emitting layers, the intermediate electrode layer being a single layer or a multilayer structure, at least one of the layers comprising a semiconductive material, the semiconductive material comprising an acceptor and a donor, wherein the acceptor is a conductive oxide comprising a transition metal and is selected from the group consisting of NbO_x, LaO_x, NdO_x, SmO_x, EuO_x, MoO_x, ReO_x, WO_x, OsO_x, IrO_x and PtO_x, wherein x is 0.2 to 5, and the donor is an alkali metal and/or an alkaline earth metal.

Tanaka does not disclose applicants' claimed intermediate electrode layer comprising a semiconductive material comprising an acceptor that is a conductive oxide containing a transition metal, and a donor, in the same layer. In Tanaka, the conductive oxide (CuO or In-Zn-O) and the donor (alkali metal and/or alkaline earth metal) are not present in the same layer. Tanaka discloses stacked layers of P-type semiconductor and N-type semiconductor:

As the intermediate conductive layer, if being the layer capable of injecting holes from one primary surface side and of injecting electrons from the other primary surface side, as well as keeping the approximate equipotential in the layer, the various kinds can be used. To list preferable examples, they are:

- (a) an ultra-thin film metal/the transparent electrode;
- (b) a mixed layer of an electron transport ability compound and an electron injection ability compound/the transparent electrode;
- (c) a mixed layer of a carbon compound and an alkali metal;
- (d) a hole conducting ability organic layer/an electron conducting ability organic layer;
- (e) P-type semiconductor/N-type semiconductor; and
- (f) a P-type conducting ability high polymer/a N-type semiconductor. Furthermore, whatever one plane is hole injecting ability and the other plane is electron injecting ability, by combining from some which are used as the intermediate conductive layer of the item (a) to the item (f) such as the thin film metal, the transparent electrode, the mixed layer of the electron transport ability compound and the electron injection ability compound, the hole conducting ability organic layer or P-type or N-type semiconductor, the uses can be more preferably performed.

Tanaka at column 7, lines 42-67 (emphasis added here). See also Tanaka's examples (disclosing an intermediate layer including a layer of Alq:Li or Mg:Ag and a conductive oxide film (obtained via sputtering) of In-Zn-O). In Tanaka, the donor is mixed with an electron transport material (such as Alq), not with the acceptor (see Tanaka's Examples).

Contrary to the assertion in the Office Action, Tanaka does not teach that the hole injecting materials and the electron injecting materials of items (a) to (f) may be combined in the same layer but that "one plane [has] hole injecting ability and the other plane [has]

electron injecting ability” (Tanaka, column 7, lines 59-61 (emphasis added here)). This means that the hole injecting materials from (a) to (f) may be combined in the layer with hole injecting ability, and the electron injecting materials from (a) to (f) may be combined in the layer with electron injecting ability.

Furthermore, Tanaka does not teach or suggest applicants’ claimed conductive oxide selected from the group consisting of NbO_x, LaO_x, NdO_x, SmO_x, EuO_x, MoO_x, ReO_x, WO_x, OsO_x, IrO_x and PtO_x, wherein x is 0.2 to 5.

Applicants’ organic electroluminescent device achieves superior efficiency and lifetime. Compare applicants’ Example 1 with Comparative Example 1 in Table 1 at page of applicants’ specification. Comparative Example 1 is similar to Tanaka and includes an intermediate layer of Alq:Li and ITO (Alq:Li is labeled as an electron injection layer in applicants’ specification but is part of the intermediate layer in Tanaka). Evidence that the claimed invention yields unexpectedly improved properties, or properties not present in the prior art rebuts an obviousness rejection. See In re Dillon, 919 F.2d 688, 692-93 (Fed. Cir. 1990); MPEP § 2145. Thus, applicants’ organic electroluminescent device is not obvious over Tanaka.

Neither Mori nor Tsutsui teaches or suggests what is missing from Tanaka. Tsutsui says nothing about applicants’ claimed intermediate electrode layer comprising a conductive oxide selected from the group consisting of NbO_x, LaO_x, NdO_x, SmO_x, EuO_x, MoO_x, ReO_x, WO_x, OsO_x, IrO_x and PtO_x and an alkali metal and/or an alkaline earth metal donor, in the same layer.

Nor does Mori teach or suggest what is missing from Tanaka. Tanaka discloses an intermediate layer including a layer for injecting holes and a layer for injecting electrons (Tanaka at column 7, lines 42-46). Mori, on the other hand, teaches the use of conductive

oxides as stabilizing compounds for low work function sodium or potassium cathodes. Mori says nothing about using such oxides as an acceptor material. Tanaka already uses a separate layer of In-Zn-O as the acceptor/hole injecting material. A person of ordinary skill in the art would not be motivated to combine Tanaka and Mori.

In addition, while Mori states that conductive oxides are suitable for use in a cathode to stabilize the sodium or potassium material, Mori does not say that the conductive oxides enhance the injection efficiency of the cathode. To the contrary, Mori explains that:

If the cathode can be made up of sodium and/or potassium elements alone, it is then possible to make the work function lowest. However, since the sodium and/or potassium elements are extremely reactive and, hence, unstable materials, it is preferable to mix them with relatively stable other metal for stabilization.

Mori at column 3, lines 28-33.

Furthermore, the results of a claimed combination are not obvious if they are unexpected. MPEP § 2141(V). In this case, Mori suggests using oxides as stabilizing agents, and a person of ordinary in this art could not have expected achieving applicants' superior organic electroluminescent device by using Mori's oxides in Tanaka's intermediate layer. To the contrary, Mori suggests that the oxides result in lower electron injection efficiency.

Thus, none of Tanaka, Mori and Tsutsui discloses or suggests applicants' claimed invention. In addition, there is no disclosure or suggestion in any of Tanaka, Mori, Tsutsui or anything else in this record that would have suggested the desirability of combining any portions thereof effectively to anticipate or render obvious applicants' claimed invention. Applicants respectfully request reconsideration and withdrawal of this rejection.

4. Claims 10-12 were rejected under 35 U.S.C. § 103(a) over Tanaka in view of Liao et al. U.S. Patent Application Publication 2003/0170491. Claims 10-12 have been cancelled thereby mooted the rejection of those claims.

5. Claims 13, 17 and 29 were rejected under 35 U.S.C. § 103(a) over Parthasarathy et al. U.S. Patent 6,420,031 in view of Mori. Claims 13, 17 and 29 have been cancelled thereby mooting the rejection of those claims.

6. Claims 14-16 were rejected under 35 U.S.C. § 103(a) over Parthasarathy in view of Tsutsui and Okada et al. U.S. Patent 6,143,434. Claims 14-16 have been cancelled thereby mooting the rejection of those claims.

7. Claims 18-23 and 30 were rejected under 35 U.S.C. § 103(a) over Tanaka. Claims 18-21 and 30 have been cancelled. Claim 23 depends from claim 22.

Claim 22 recites an organic electroluminescent device comprising: a substrate, an anode, a hole injecting layer, a hole transporting layer, an emitting layer, an electron injecting layer, and a cathode, in this order, at least one of the hole injecting layer and the electron injecting layer being a bipolar charge injection layer, wherein the bipolar charge injection layer comprises a mixture of at least one element single substance selected from the group of Cs, Li, Na and K; and at least one oxide selected from the group of MoO_x, VO_x, ReO_x, RuO_x, WO_x, ZnO_x, and TiO_x, wherein x is 0.5 to 5.

Tanaka does not disclose applicants' claimed organic electroluminescent device. Tanaka says nothing about a hole injecting layer or electron injecting layer being a bipolar charge injection layer comprising a mixture of a one element single substance selected from the group of Cs, Li, Na and K; and an oxide selected from the group of MoO_x, VO_x, ReO_x, RuO_x, WO_x, ZnO_x, and TiO_x.

Thus, Tanaka does not disclose all elements of applicants' claims. In addition, Tanaka discloses nothing that would have suggested applicants' claimed invention to one of ordinary skill in this art. There is no disclosure or teaching in Tanaka or otherwise in this record, that would have suggested the desirability of modifying any portions thereof effectively to anticipate or suggest applicants' presently claimed invention. Applicants respectfully request reconsideration and withdrawal of this rejection.

8. Claim 27 was rejected under 35 U.S.C. § 103(a) over Tanaka in view of Forrest et al. U.S. Patent 5,703,436. Claim 27 depends from claim 22.

As discussed above, Tanaka does not disclose all elements of claim 22. Forrest does not teach or suggest what is missing from Tanaka. Forrest nowhere discloses applicants' claimed organic electroluminescent device having applicants' claimed bipolar charge injection layer.

Thus, neither Tanaka nor Forrest discloses or suggests applicants' claimed invention. In addition, there is no disclosure or suggestion in any of Tanaka, Forrest, or anything else in this record that would have suggested the desirability of combining any portions thereof effectively to anticipate or render obvious applicants' claimed invention. Applicants respectfully request reconsideration and withdrawal of this rejection.

Accordingly, all claims 1, 22, 23, 27, 28, 30 and 32-37 are now fully in condition for allowance and a notice to that effect is respectfully requested. The PTO is hereby authorized to charge/credit any fee deficiencies or overpayments to Deposit Account No. 19-4293. If further amendments would place this application in even better condition for issue, the Examiner is invited to call applicant's undersigned attorney at the number listed below.

Respectfully submitted,

STEPTOE & JOHNSON LLP

Date: September 21, 2009

Houda MORAD
Roger W. Parkhurst
Reg. No. 25,177
Houda Morad
Registration No. 56,742

STEPTOE & JOHNSON LLP
1330 Connecticut Ave., N.W.
Washington, D.C. 20036
Tel: (202) 429-3000
Fax: (202) 429-3902